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A History of Oil- and Gas-Well Blowouts in California

· 1950 - 1990 ·

Department of Conservation

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A History of Oil- and Gas-Well Blowouts in California

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BY
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CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES
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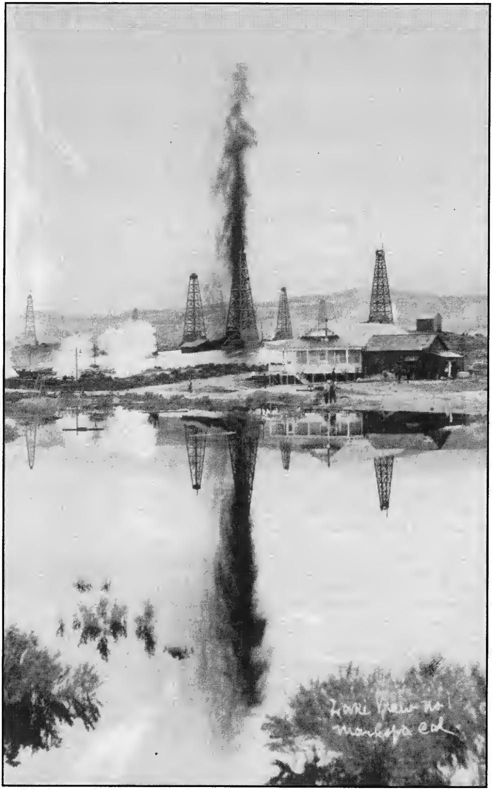

Well Lakeview No. 1, California's greatest gusher, located in Midway-Sunset oil field. The well blew out in 1910 and flowed oil at rates estimated as high as 125,000 barrels per day. The Lakeview gusher flowed for an 18-month period and produced an estimated 9 million barrels of oil.

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In 1986, as well No. 566ER-29 was being drilled into a deeper zone, steam from a pocket in a thin sand undergoing steam-injection activities blew through the rig crown block. *Photo by Elizabeth Johnson.*

A HISTORY OF OIL- AND GAS-WELL BLOWOUTS IN CALIFORNIA

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INTRODUCTION

A blowout, defined as the uncontrolled flow of formation fluids from a well bore, is one of the most dramatic of all oilfield events. Fortunately, blowouts are rare occurrences today.

Blowouts occur when formation fluids flow uncontrolled into a low-pressure subsurface zone (an underground blowout) or to the surface (a surface blowout). Most commonly, a blowout happens when there is insufficient pressure in a well bore to control subsurface pressures. If well-bore pressures are allowed to drop to a point where formation fluids enter the well bore, a "kick" will occur. A kick can be the beginning of a blowout. When a kick is detected during drilling operations, the blowout prevention equipment (BOPE) is closed, sealing the well bore and preventing additional formation fluids from entering the well. The drilling crew then undertakes additional kick-control measures. Usually, heavier drilling fluid is circulated down the well bore until control is regained and normal operations can continue.

In California, Section 3106 of the *Public Resources Code* requires the State Oil and Gas Supervisor to "so supervise the drilling, operation, maintenance, and abandonment of wells... to prevent, as far as possible, damage to life, health, property, and natural resources..." This responsibility extends to any well drilled for recovery of oil, gas, or geothermal resources. The California Department of Conservation-Division of Oil, Gas, and Geothermal Resources carries out these mandates through a regulatory program designed to prevent well blowouts.

WELL-BORE PRESSURE CONTROL

During drilling, completion, or plugging and abandonment operations, proper well-bore pressure control is the key to preventing blowouts. There are two ways to control well pressures.

The primary method is by hydrostatic pressure, created when a well is filled with fluid, which is most often drilling mud. The amount of hydrostatic pressure exerted by a column of drilling fluid is determined by the vertical height of the fluid column and by the weight (density) of the fluid itself. Normally, the hydrostatic pressure of the drilling fluid is kept slightly above that of the formation fluids. This pressure overbalance prevents formation fluids from entering the well bore.

The secondary method of well control is the use of BOPE, which can be activated to close and seal a well bore at any time and under almost any conditions. The type of BOPE required is determined when evaluating the proposed depth of the well, the nature of the strata to be penetrated, and the surface environment.

The BOPE is fastened securely to the well casing, which must be cemented at a depth that will safely permit the crew to use adequate well-control procedures. If the casing is not set deeply enough, lost circulation of drilling fluids or an underground blowout may occur through weak, low-pressure zones exposed below the casing. Lost circulation, which occurs when drilling fluid passes from the well bore into a low-pressure zone, can lead to a blowout through a loss of hydrostatic pressure. An underground blowout occurs when formation fluids move through the well bore from one zone to another. This often causes the fracturing of a weak, low-pressure zone below the casing and allows well fluids to flow to the surface outside the casing in an uncontrolled manner.

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[a] Manuscript submitted April 1992.

STEAM PROJECTS AND BLOWOUTS

Heavy oil is too viscous to be produced easily without using enhanced oil recovery techniques. Typically, steam is injected into a heavy-oil reservoir to lower the oil's viscosity and enhance flow within the reservoir, thereby assisting the production process.

In 1990, 52 percent of the total oil produced in California came from steam-injection projects. In recent years, steam blowouts in such projects have become the most common type of blowout in California. In fact, 19 of the 31 oil- and gas-well blowouts between 1984 and 1990 were steam blowouts.

Usually, steam blowouts occur when a high-pressure zone undergoing steam injection is penetrated by a well whose drilling fluid column is insufficient to control the zone pressure. Also, steam blowouts can occur when high-pressure steam reaches old wells that were not plugged and abandoned according to modern engineering standards.

Most steam blowouts are not as serious as other oil- and gas-well blowouts because steam is not combustible; hence, the dangers of fire are minimized. Also, steam blowouts can usually be quenched with relative ease by injecting cold water into the well bore.

DATA IN THIS REPORT

In October and November 1950, *World Oil* published a two-part article titled "Well Blowouts in California Drilling" that evaluated the nature and cause of California oil- and gas-well blowouts from 1940 to 1949. Tables from the article are reprinted as Table A in this report.

Table B shows the ratio of blowouts to wells drilled from 1950 to 1990, by year. Table C is a tabulation of the number of oil and gas wells drilled and producing in California. Table D is a detailed study of oil- and gas-well blowouts from 1950 to 1990, based on data from the division's records. The data in Table D include: date, operator, field, well, injuries (if any), fire (if any), duration, substances blown from the well bore, the well operation underway at the time of blowout, and the cause of the blowout. The blowouts are listed chronologically.

STUDY RESULTS

From 1950 to 1990, there were 101,578 oil and gas wells drilled in California. Of the 139 blowouts that occurred in this period, 52 took place during drilling operations, 16 took place during completion operations, 10 during plugging and abandonment operations, and 61 during other well operations. Twenty-four of these blowouts occurred in steam-injection projects.

The causes of the blowouts that occurred during drilling operations fell most commonly within three categories, which result from human error: (1) failure to maintain adequate drilling fluid weight; (2) failure to keep the hole full of drilling fluid; and (3) failure to prevent swabbing. These categories accounted for about 55 percent of the blowouts from 1950 to 1990. This fact is recognized widely by both the oil and gas industry and regulatory agencies that, together, stress the importance of drilling crew blowout-prevention training programs.

In discussions of blowouts during drilling operations, lost circulation is frequently mentioned as a common cause; however, this study indicates that lost circulation leading to a blowout has been a rare occurrence in California. Only 4 of the 52 drilling-operation blowouts were due to lost circulation alone.

From a statistical standpoint, the number of blowouts during drilling operations is about five one-hundredths of one percent of the total wells drilled, and is smaller than the number of blowouts that occurred during nondrilling operations (e.g., during workovers, completions, etc.).

SELECTED REFERENCES

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Horn, A. J., 1950, Well blowouts in California drilling, part one: *World Oil*, October 1950, p. 99-104.

Horn, A. J., 1950, Well blowouts in California drilling, part two: *World Oil*, November 1950, p. 132-138.

GLOSSARY

BLOWOUT - An uncontrolled flow of well fluids and/or formation fluids from the well bore to the surface (surface blowout), or into lower-pressured subsurface zones (underground blowout).

BLOWOUT PREVENTION EQUIPMENT (BOPE) - The entire array of equipment installed at the well to control kicks and prevent blowouts. Consists of the preventers, actuating system, and auxiliary equipment.

DRILLING FLUID DENSITY - Weight of the working fluid per unit volume, usually expressed as pounds per gallon or pounds per cubic foot. The density is increased by adding a weighting material, such as barite.

DRILLING FLUID (DRILLING MUD) - A mixture of water and inert clay minerals. Performs several valuable functions during the drilling of a well, including the control of subsurface pressures.

FLUID COLUMN HEIGHT - The height of fluid in the well bore. For pressure calculations, this height must be true vertical height.

FORMATION FLUIDS - Naturally occurring water, gas, and oil that may be under pressure.

FORMATION PRESSURE - The naturally occurring pore pressure due to artesian continuity, the overburden of soil and rocks, and/or unusual geological conditions.

HYDROSTATIC PRESSURE - The pressure exerted by a column of fluid. The amount of pressure is dependent upon the density of the fluid and the vertical height of the fluid column.

KICK - The unscheduled intrusion of formation liquids or gas into the well bore. Without corrective measures, this can result in a blowout.

LOST CIRCULATION - The loss of working fluid, in quantity, to the formation.

SWABBING - A process created when tight-fitting drill pipe or tools are pulled from the well bore, creating a suction that draws drilling fluid up and out of the hole, allowing formation fluid to enter the well bore.

UNLOADING THE WELL - The process whereby the fluid column in a well bore is forced out, usually due to gas entering the well bore.

WORKING FLUID - Any fluid put in the well bore to control pressure and serve as a circulation medium.

Table A. Well Blowouts in California Drilling Operations (1940-1949).*

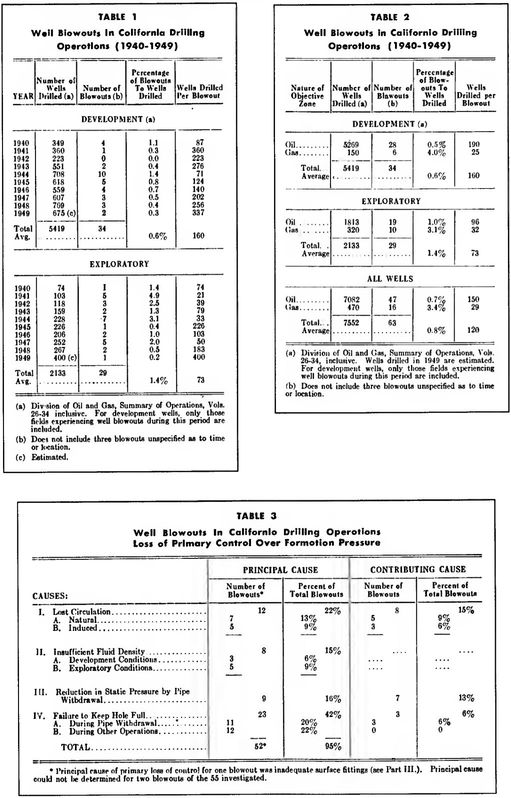

TABLE 1

Well Blowouts In California Drilling Operations (1940-1949)

YEAR	Number of Wells Drilled (a)	Number of Blowouts (b)	Percentage of Blowouts To Wells Drilled	Wells Drilled Per Blowout
		DEVELOPMENT (a)		
1940	349	4	1.1	87
1941	360	1	0.3	360
1942	223	0	0.0	223
1943	551	2	0.4	276
1944	708	10	1.4	71
1945	618	5	0.8	124
1946	559	4	0.7	140
1947	607	3	0.5	202
1948	769	3	0.4	256
1949	675 (c)	2	0.3	337
Total	5419	34		
Avg.	....	....	0.6%	160
		EXPLORATORY		
1940	74	1	1.4	74
1941	103	5	4.9	21
1942	118	3	2.5	39
1943	159	2	1.3	79
1944	228	7	3.1	33
1945	226	1	0.4	226
1946	206	2	1.0	103
1947	252	5	2.0	50
1948	267	2	0.5	183
1949	400 (c)	1	0.2	400
Total	2133	29		
Avg.	....	....	1.4%	73

(a) Division of Oil and Gas, Summary of Operations, Vols. 26-34 inclusive. For development wells, only those fields experiencing well blowouts during this period are included.

(b) Does not include three blowouts unspecified as to time or location.

(c) Estimated.

TABLE 2

Well Blowouts in California Drilling Operations (1940-1949)

Nature of Objective Zone	Number of Wells Drilled (a)	Number of Blowouts (b)	Percentage of Blowouts To Wells Drilled	Wells Drilled per Blowout
		DEVELOPMENT (a)		
Oil.........	5269	28	0.5%	190
Gas........	150	6	4.0%	25
Total.	5419	34		
Average	....	....	0.6%	160
		EXPLORATORY		
Oil	1813	19	1.0%	96
Gas	320	10	3.1%	32
Total. .	2133	29		
Average	....	....	1.4%	73
		ALL WELLS		
Oil.........	7082	47	0.7%	150
Gas........	470	16	3.4%	29
Total. .	7552	63		
Average	....	....	0.8%	120

(a) Division of Oil and Gas, Summary of Operations, Vols. 26-34, inclusive. Wells drilled in 1949 are estimated. For development wells, only those fields experiencing well blowouts during this period are included.

(b) Does not include three blowouts unspecified as to time or location.

TABLE 3

Well Blowouts In California Drilling Operations Loss of Primary Control Over Formation Pressure

CAUSES:	PRINCIPAL CAUSE				CONTRIBUTING CAUSE			
	Number of Blowouts*		Percent of Total Blowouts		Number of Blowouts		Percent of Total Blowouts	
I. Lost Circulation.........................		12		22%		8		15%
A. Natural............................	7		13%		5		9%	
B. Induced..........................	5		9%		3		6%	
II. Insufficient Fluid Density		8		15%		....		....
A. Development Conditions...........	3		6%		....		....	
B. Exploratory Conditions.............	5		9%		....		....	
III. Reduction in Static Pressure by Pipe Withdrawal.........................		9		16%		7		13%
IV. Failure to Keep Hole Full..............		23		42%		3		6%
A. During Pipe Withdrawal...........	11		20%		3		6%	
B. During Other Operations...........	12		22%		0		0	
TOTAL............................		52*		95%				

* Principal cause of primary loss of control for one blowout was inadequate surface fittings (see Part III.). Principal cause could not be determined for two blowouts of the 55 investigated.

*Reprinted, with permission, from "Well Blowouts in California Drilling," by A. J. Horn, published in *World Oil,* October 1950.

Table B. Well Blowouts in California During Drilling Operations (1950-1990).

Year	No. of Wells Drilled	No. of Blowouts	Blowouts as a % of Wells Drilled	Wells Drilled per Blowout
1950	1,726	2	0.12	863
1951	2,260	3	0.13	753
1952	2,368	1	0.04	2,368
1953	2,518	3	0.12	839
1954	2,365	1	0.04	2,365
1955	2,644	2	0.08	1,322
1956	2,372	0	-	-
1957	2,464	1	0.04	2,464
1958	1,554	1	0.06	1,554
1959	1,539	1	0.06	1,539
1960	1,828	3	0.16	609
1961	2,203	2	0.09	1,102
1962	2,779	5	0.18	556
1963	2,850	0	-	-
1964	2,787	2	0.07	1,394
1965	2,495	0	-	-
1966	2,503	3	0.12	834
1967	2,808	3	0.11	936
1968	2,637	0	-	-
1969	2,054	1	0.05	2,054
1970	2,095	1	0.05	2,095
1971	2,120	0	-	-
1972	1,353	1	0.07	1,353
1973	1,324	0	-	-
1974	2,376	2	0.08	1,188
1975	2,695	0	-	-
1976	2,677	0	-	-
1977	2,696	1	0.04	2,696
1978	2,306	1	0.04	2,306
1979	2,273	1	0.04	2,273
1980	2,259	0	-	-
1981	3,987	1	0.03	3,987
1982	3,099	1	0.03	3,099
1983	2,920	1	0.03	2,920
1984	4,334	2	0.05	2,167
1985	4,105	0	-	-
1986	2,363	1	0.04	2,363
1987	2,683	3	0.11	894
1988	2,571	1	0.04	2,571
1989	2,096	0	-	-
1990	2,492	1	0.04	2,492
Total	101,578	52	0.05	1,992 (Avg.)

Table C. Oil- and Gas-Well Statistics for California.

Part 1. Total number of wells drilled.

Pre-1915	12,796
1915-1949	39,674
1950-1990	101,578
Total	154,048

Part 2. Number of wells drilled, 1950 to 1990, and active and inactive wells.

Oil and Gas Wells Drilled (1950-1990)				Producing Oil and Gas Wells (Federal OCS Included)		
Year	Onshore & State Offshore	Federal Offshore (OCS)*	Total	Active	Inactive	Total
1950	1,726[a]	0	1,726	27,369	6,569	33,938
1951	2,260[a]	0	2,260	29,741	5,793	35,534
1952	2,368[a]	0	2,368	31,096	5,946	37,042
1953	2,518[a]	0	2,518	32,382	6,125	38,507
1954	2,365[a]	0	2,365	33,244	6,934	40,178
1955	2,644[b]	0	2,644	34,731	6,815	41,546
1956	2,372[b]	0	2,372	35,967	6,352	42,319
1957	2,464[b]	0	2,464	37,435	6,953	44,388
1959	1,554[b]	0	1,554	36,113	9,133	45,246
1959	1,539[b]	0	1,539	37,421	8,291	45,712
1960	1,828[b]	0	1,828	37,887	8,318	46,205
1961	2,203	0	2,203	38,674	8,336	47,010
1962	2,779	0	2,779	39,786	9,254	49,040
1963	2,848	2	2,850	40,960	10,274	51,234
1964	2,780	7	2,787	41,921	10,504	52,425
1965	2,484	11	2,495	42,241	11,688	53,929
1966	2,497	6	2,503	42,392	12,817	55,209
1967	2,796	12	2,808	42,720	13,867	56,587
1968	2,570	67	2,637	42,821	15,071	57,892
1969	1,967	87	2,054	42,200	16,715	58,915
1970	2,012	83	2,095	41,947	17,735	59,682
1971	2,082	38	2,120	41,423	18,726	60,149
1972	1,341	12	1,353	40,855	19,449	60,304
1973	1,319	5	1,324	40,049	19,667	59,716
1974	2,366	10	2,376	41,293	18,249	59,542
1975	2,681	14	2,695	42,264	18,408	60,672
1976	2,659	18	2,677	43,606	18,375	61,981
1977	2,637	59	2,696	44,626	18,788	63,414
1978	2,272	34	2,306	44,947	17,997	62,944
1979	2,241	32	2,273	45,324	18,132	63,456
1980	2,208	51	2,259	45,874	18,458	64,332
1981	3,923	64	3,987	50,836	15,007	65,843
1982	3,015	84	3,099	51,667	15,624	67,291
1983	2,838	82	2,920	51,437	16,687	68,124
1984	4,270	64	4,334	53,420	17,197	70,617
1985	4,060	45	4,105	54,738	17,596	72,334
1986	2,324	39	2,363	54,970	18,765	73,735
1987	2,640	43	2,683	51,948	23,304	75,252
1988	2,539	32	2,571	51,271	24,313	75,584
1989	2,080	16	2,096	49,313	26,258	75,571
1990	2,476	16	2,492	51,778	24,497	76,275
Total	100,545	1,033	101,578			

[a] The number of wells completed, plus the number of exploratory wells abandoned.

[b] Estimated numbers based on best available data.

*Statistics from Publication 90-0013, 1990, published by the U.S. Department of the Interior, Minerals Management Service.

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Drilling Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
04/05/50	Shell Oil Co.	South Mountain	"Calco-Schieferle" 5	3-1/4 hours	No	Oil, gas, mud, & rocks	None
OPERATION:	Pulling drill pipe after cutting a core.	CAUSE:	Insufficient hole fluid.				
06/20/50	Lebow-McNee Oil Co.	Fruitvale	"KCL" 65-D	6-1/2 hours	No	Gas, sand, & water	None
OPERATION:	Pulling drill pipe while redrilling.	CAUSE:	Swabbed the well.				
09/01/51	Richfield Oil Corp.	South Cuyama	"Hibberd" 78-36	74 hours	No	Gas	None
OPERATION:	Pulling drill pipe after cutting a core.	CAUSE:	Inadequate mud weight. (Also, 4-1/2" pipe rams were installed while using 3-1/2" drill pipe and the CSO rams failed.)				
09/16/51	The Texas Company	San Ardo	"Orradre" C13-11	2 hours	Yes	Gas	None
OPERATION:	Pulling drill pipe after drilling out the 8-5/8"casing shoe.	CAUSE:	Insufficient hole fluid, possibly due to lost circulation.				
12/02/51	Fullerton Oil Co.	Piru	"N.L.& F." 0-4	3-1/2 days	No	Oil & water	None
OPERATION:	Coring.	CAUSE:	No BOPE. (Also, inadequate fluid weight.)				
11/25/52	Balken and Krug	Hollister	"Ferry-Morse" 1	24 hours	No	Gas	None
OPERATION:	Pulling drill pipe.	CAUSE:	Swabbed the well. Inadequate mud weight may have been a contributing factor. (Also, the annular preventer failed.)				
03/01/53	Golden Gate Gas & Oil Dev., Co.	Petaluma (?)	"Golden Gate" 3	Unknown	(?)	(?)	(?)
OPERATION:	Drilling with a cable tool rig.	CAUSE:	No BOPE.				

03/31/53	Standard Oil Co.	Oxnard	"McInnes" 1	5 minutes	Yes	Gas	None
OPERATION:	Drilling.	CAUSE:	Lost circulation.				
09/30/53	Reserve Oil and Gas Co.	Pyramid Hills	"Orchard" 48-20	2 days	No	Gas	None
OPERATION:	Drilling.	CAUSE:	Inadequate mud weight (73 lbs. per cubic foot). 92 lbs. mud was needed to control the well.				
11/24/54	The Texas Company	Shiells Canyon	"Elkins" 8	24 hours	No	Gas	None
OPERATION:	Making up drill collars after drilling to 2,970 feet (no tools in hole).	CAUSE:	Inadequate mud weight and surface casing (201 feet). After the well began to flow, drill collars were run into the hole and the annular preventer was closed. Gas then broke out of fissures 25 to 200 feet from the well.				
04/10/55	Zephyr Oil Co.	Huntington Beach	"Mayhew" 1	15 minutes	No	Oily mud	None
OPERATION:	Drilling ahead.	CAUSE:	Inadequate mud weight.				
06/15/55	General Petroleum Corp.	Willows-Beehive Bend Gas	"Hill-Elvidge" 1	3 days	No	Gas & water	None
OPERATION:	Conditioning mud while on bottom.	CAUSE:	Inadequate mud weight (compounded by insufficient surface casing). Note: gas and water broke through fissures 300 to 500 feet from the well after the well was shut in.				
08/13/57	Tidewater Oil Co.	Ventura	"Lloyd" 183	2 hours	Yes	Oil-based mud	1 dead, 2 injured
OPERATION:	Running back to total depth after making a connection.	CAUSE:	Inadequate fluid weight (oil-based mud).				

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Drilling Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
06/11/58	Intex Oil Co.	Tapia	"Yule" 4	30 minutes	No	Gas	None
OPERATION:	Pulling drill pipe.	CAUSE:	Swabbed well. (In addition, no one activated the BOPE after the blowout started.)				
06/05/59	G. E. Kadane & Sons	Suisun Bay Gas	"Standard-Suisun Community" 10	(?) days	No	Gas & water	None
OPERATION:	Pulling drill pipe (prior to running surface casing).	CAUSE:	Swabbed the well. (Also, there was no surface casing in the well, which allowed a crater to form at the approximate well location.) The rig was lost in the crater.				
03/19/60	Union Oil Co. of Calif.	South Mountain	"Hill" 3	20 minutes	Yes	Gas	5 injured
OPERATION:	Conditioning mud after an unsuccessful production test of a redrilled well. (The mud had been circulated for an hour.) Began pulling the drill pipe after noticing gas-cut mud.	CAUSE:	Inadequate fluid weight.				
06/19/60	Occidental Petroleum Corp.	Arbuckle Gas	"Arbuckle Section 4 Unit" 1	A few minutes	No	Saltwater	None
OPERATION:	Running back to bottom with new bit.	CAUSE:	Inadequate mud weight (130 lbs. per cubic foot), probably compounded by running into the hole too fast, and breaking down the formation. (In addition, the packing element of the annular preventer blew out and the pipe rams leaked after they were closed.)				
11/14/60	Kern Oil California Ltd.	Edison	No. 34-36	Unknown	Yes	Gas	None
OPERATION:	Displacing hole fluid with drilling mud prior to deepening.	CAUSE:	Circulated a gas bubble while the BOPE was open.				

06/13/61	CWOD Co.	Midway-Sunset	No. 95	35 hours	Yes	Gas	None	OPERATION: Changing the bit.	CAUSE: Insufficient hole fluid. Also, no BOPE was installed.
10/17/61	Socony Mobil Oil Co.	Midway-Sunset	"MOCO 35" 204-A	Unknown	No	Mud	None	OPERATION: Logging the well.	CAUSE: Inadequate mud weight. (When the BOPE was shut, some of the mud surfaced through fissures about 1/4 mile away.) The area was undergoing fireflood operations.
01/06/62	Drilling & Production Co.	Petaluma	"Petaluma Community 5" 7	3 days	No	Gas	None	OPERATION: Pulling drill pipe off bottom.	CAUSE: Swabbed the well. (Also, there was insufficient surface casing in the well, which allowed a breakdown at the casing shoe and flow to the surface.)
06/20/62	Shell Oil Co.	Contra Costa County	"Ginochio" 2-9	1 day	No	Gas	None	OPERATION: Pulling drill pipe and testing tool.	CAUSE: Insufficient hole fluid. (Also, there was insufficient surface casing, which allowed a breakdown at the casing shoe.) Note: several craters formed during the blowout. One was 75 feet from the well.
07/08/62	Santa Fe Drilling Co.	Sutter Buttes Gas	"Buttes Community" 36	2 days	No	Gas	None	OPERATION: Circulating while preparing for a drillstem test.	CAUSE: Inadequate mud weight.
07/28/62	Standard Oil Co.	Midway-Sunset	No. 8-3	8 hours	Yes	Gas w/trace of oil	None	OPERATION: Pulling drill collars.	CAUSE: Inadequate mud weight (oil-based mud). (The drill collars were blown from the well before the annular preventer could be closed.) No CSO rams.

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Drilling Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
12/07/62	Continental Oil Co.	San Miguelito	"Grubb" 58	5 hours	Yes	Mud & gas	None
OPERATION:	Pulling drill pipe after setting a whipstock for redrilling.	CAUSE:	Inadequate mud weight. (Also, although tested earlier, the BOPE failed to operate.)				
02/08/64	Union Oil Co. of Calif.	None - federal offshore	"Santa Barbara Core Hole" 10	46 hours	No	Gas	None
OPERATION:	Pulling drill pipe after conditioning the hole for casing.	CAUSE:	No BOPE and inadequate mud weight.				
06/16/64	Lynn Hall, Jr., Opr.	Sespe	"Hawkswing" 2	3 hours	Yes	Gas	1 injured
OPERATION:	Running drill pipe (air drilling).	CAUSE:	No BOPE. (The rotating head had been removed when the rig was converted from a cable tool rig to a rotary rig.)				
10/21/66	Tidewater Oil Co.	Ventura	"V. L. & W." 141	1 hour	Yes	Gas	1 injured
OPERATION:	Conditioning the hole after logging.	CAUSE:	Inadequate mud weight. (Possibly an accumulation of trip gas in the cellar.)				
11/12/66	Occidental Petroleum Corp.	Beverly Hills	"West Pico" 7	3 minutes	No	Mud	None
OPERATION:	Drilling directionally.	CAUSE:	Drilled into a producing well.				
11/12/66	Amerada Hess Corp.	Lindsey Slough Gas	"Atlantic Richfield-Petersen Est." 2	A few minutes	No	Mud	None
OPERATION:	Running drill pipe into the hole with a new bit.	CAUSE:	Inadequate mud weight (101 lbs. per cubic foot).				
02/05/67	Union Oil Co. of Calif.	Lindsey Slough Gas	"H. E. Petersen" 1	Unknown	No	Gas	None
OPERATION:	Drilling.	CAUSE:	Inadequate mud weight (72 lbs. per cubic foot). Note: the high pressure encountered at a shallow depth was caused by a casing leak in an adjacent well.				

08/13/67	Atlantic Richfield Co.	Las Cienegas	"St. James" 16	1 hour	Yes	Gas	1 dead, 7 injured

OPERATION: Pulling out of hole.

CAUSE: Swabbed the well. The BOPE was closed, but gas was able to pass to the mud pumps, where it ignited.

10/14/67	Standard Oil Co.	Oxnard	"Davis" 2	32 hours	Yes	Gas	4 injured

OPERATION: Displacing drilling mud with crude oil.

CAUSE: Unexpected gas in the oil returns. (In addition, the BOPE was apparently damaged by the fire.)

01/28/69	Union Oil Co. of Calif.	Dos Cuadras Offshore	No. A-21	11 days	No	Oil & gas	None

OPERATION: Pulling drill pipe (preparing to run logs).

CAUSE: Swabbed the hole. In addition, the drill pipe was dropped down the hole, thereby eliminating any means of controlling the well, and insufficient surface casing allowed the well to blow out around the shoe of the surface casing after the well was shut in.

01/14/70	Dr. James O. Crittenden	Pyramid Hills	"Orchard" 29-3	2 hours	No	Gas	None

OPERATION: Drilling (sidetracking fish).

CAUSE: Inadequate mud weight. (In addition, the annular preventer began to leak due to improper well-killing techniques).

12/21/72	Union Oil Co. of Calif.	Las Cienegas	"Murphy" 27	A few minutes	No	Mud & sand	None

OPERATION: Pulling drill pipe.

CAUSE: Inadequate fluid level. (The hole was not filled often enough - every five stands.) Also, there may have been some swabbing.

03/30/74	L. W. Babcock	Union Avenue	"Pon" 1	18 hours	Yes	Gas, water, sand, & gravel	1 injured

OPERATION: Changing the bit.

CAUSE: Inadequate mud weight. (In addition, the hydraulic control lines for the BOPE were not hooked up.)

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Drilling Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
05/17/74	Pacific Gas and Electric Co.	McDonald Island Gas	"Whisky Slough" 14-W	19 days	Yes	Gas	None
OPERATION:	Pulling drill pipe.	CAUSE:	Swabbed the well (a 7 5/8-inch bit on 5-inch drill pipe in 8 5/8-inch casing).				
12/03/77	Williams Brothers Eng. Co.	Elk Hills	No. 86-24Z	35 hours	No	Gas & mud	None
OPERATION:	Wiping the hole with the drill bit.	CAUSE:	Insufficient hole fluid. The surface casing did not cover a lost-circulation zone, and the hole was not kept full of fluid.				
08/16/78	Texaco Inc.	Pitas Point Offshore Gas	"Pitas Point Unit" 5	7 days (kick)	No	Mud & gas	None
OPERATION:	Drilling out a kickoff plug.	CAUSE:	Inadequate mud weight.				
09/09/79	Southern California Gas Co.	Aliso Canyon	"SFZU" MA-1B	2 hours	No	Gas & mud	None
OPERATION:	Opening the bottom hole prior to running a liner.	CAUSE:	Inadequate mud weight (gas-cut mud).				
03/15/81	TXO Production Corp.	Bounde Creek Gas	"Torres" 12-1	13 days	No	Gas & water	None
OPERATION:	Running drill pipe into the hole with a new bit.	CAUSE:	Inadequate mud weight. (A small-diameter hole and running into the hole too fast were probably contributing causes.) The blowout was controlled with an installed gas trap and stack.				
08/26/82	Aminoil USA, Inc.	Huntington Beach (offshore)	S-356 (Platform Emmy)	4 minutes	Yes	Gas & mud	3 injured
OPERATION:	Drilling. (Directional well.)	CAUSE:	Insufficient hole fluid. (The fluid level dropped when the well penetrated a producing well.)				
06/22/83	Chevron U.S.A. Inc.	Cymric	No. 1-4	10 hours	No	Mud, gas, & sand	3 injured
OPERATION:	Preparing to run in the hole with a bit.	CAUSE:	Insufficient hole fluid. The hole was not kept full after pulling the drill pipe.				

/17/84	Chevron U.S.A. Inc.	Carpinteria Offshore	"Exxon" 10	9 hours (kick)	No	Mud & gas	None
ON:	Pulling drill pipe.	CAUSE:	Either inadequate mud weight or isolated, high-pressure gas sand.				
9/28/84	Getty Oil Co.	Lost Hills	No. 524	3 hours	No	Steam & sand	None
TION:	Pulling drill pipe.	CAUSE:	Swabbed the well.				
09/08/86	Shell California Prod. Inc.	South Belridge	No. 566ER-29	18 hours	No	Steam	None
ATION:	Drilling. The driller was reaming the kelly after the bit began to ball up.	CAUSE:	The well had penetrated one of the thin Tulare sands that was being steamed at an updip location. The reaming action apparently swabbed the hole. After the annular preventer was closed, a 4-inch diverter line below the preventer was opened. However, the diverter system was not designed for unrestrained steam flow.				
07/07/87	Santa Fe Energy Co.	South Belridge	"King" 77WB	13 hours	No	Steam	None
ERATION:	Drilling.	CAUSE:	Inadequate mud weight. Initially, the kick was controlled by closing the annular preventer and diverting the hot mud and water into a sump. However, the steam began to seep around the surface casing and breached the surface about 200 feet from the well bore.				
09/11/87	Getty Oil Company	Lost Hills	No. 614	7 days	No	Gas	None
OPERATION:	Pulling the drill pipe after the bit plugged.	CAUSE:	Swabbed the hole. Pipe rams were engaged but would not close, and the annular preventer did not form a complete seal.				

17/84	Chevron U.S.A. Inc.	Carpinteria Offshore	"Exxon" 10	9 hours (kick)	No	Mud & gas	None
N:	Pulling drill pipe.	CAUSE:	Either inadequate mud weight or isolated, high-pressure gas sand.				
/28/84	Getty Oil Co.	Lost Hills	No. 524	3 hours	No	Steam & sand	None
TION:	Pulling drill pipe.	CAUSE:	Swabbed the well.				
09/08/86	Shell California Prod. Inc.	South Belridge	No. 566ER-29	18 hours	No	Steam	None
TION:	Drilling. The driller was reaming the kelly after the bit began to ball up.	CAUSE:	The well had penetrated one of the thin Tulare sands that was being steamed at an updip location. The reaming action apparently swabbed the hole. After the annular preventer was closed, a 4-inch diverter line below the preventer was opened. However, the diverter system was not designed for unrestrained steam flow.				
07/07/87	Santa Fe Energy Co.	South Belridge	"King" 77WB	13 hours	No	Steam	None
ERATION:	Drilling.	CAUSE:	Inadequate mud weight. Initially, the kick was controlled by closing the annular preventer and diverting the hot mud and water into a sump. However, the steam began to seep around the surface casing and breached the surface about 200 feet from the well bore.				
09/11/87	Getty Oil Company	Lost Hills	No. 614	7 days	No	Gas	None
OPERATION:	Pulling the drill pipe after the bit plugged.	CAUSE:	Swabbed the hole. Pipe rams were engaged but would not close, and the annular preventer did not form a complete seal.				

04/07/55	The Texas Company	Shiells Canyon	"Elkins" 9	4 days	No	Gas	None	OPERATION: Beginning to remove BOPE after cementing 7" casing (the production string).	CAUSE: Insufficient surface casing (406 feet) and gas-cut cement between the surface and production casings (gas channeled to the surface). The gas sand that caused the problem was apparently the same one that caused the blowout in "Elkins" 8. As cement was pumped down the annulus, gas and unset cement broke out of fissures 40 to 200 feet from the well. (A total of 6,000 sacks of cement mixed with 784 sacks of Calseal was pumped into the annulus before the fissures were sealed.)
10/23/56	W. R. Oil Co.	Ojai	"Bailey" 4	65 hours	No	Oil & gas	None	OPERATION: Spotted oil opposite the oil zone while preparing to run the liner.	CAUSE: Inadequate fluid weight. Also, tried to close the pipe rams on the kelly (no annular preventer).
06/15/60	Paul F. McKenzie	Huntington Beach	"Doug" 1	12 hours	No	Gas	None	OPERATION: Perforating.	CAUSE: Insufficient hole fluid (water). (Could not establish circulation after the blowout.)
01/24/61	Richard R. Thorup, Opr.	King City	"Thomas Doud Estate" 5	19 hours	No	Oil & gas	None	OPERATION: Running a liner (after filling the hole with crude oil).	CAUSE: Inadequate fluid weight (crude oil). (In addition, the annular preventer may have been damaged when the partially run liner was removed from the hole so the preventer could be closed.)
02/20/61	Tidewater Oil Co.	Ventura	"V.L. & W." 126	45 minutes	Yes	Oil & gas	1 injured	OPERATION: The drill pipe and tools had just been pulled from hole following a production test.	CAUSE: Inadequate fluid weight (saltwater).
09/14/61	Standard Oil Co.	Huntington Beach	"P.E." 49	6 hours	No	Gas	None	OPERATION: Gravel packing.	CAUSE: Lost circulation.

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Completion Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
06/28/62	Standard Oil Co.	Poso Creek	No. 2-5	2-1/2 hours	Yes	Gas	1 injured
OPERATION:	Preparing to run a liner after circulating out the mud and replacing it with lease crude. (There was no drill pipe in the hole.)	CAUSE:	No BOPE.				
02/12/64	Bunting & Petrie	Huntington Beach	"Burton-Davis Comm." 1	12 hours	No	Oil & gas	None
OPERATION:	Running drill pipe into the well to circulate out excess sand with crude oil (after gravel packing).	CAUSE:	Inadequate fluid weight.				
10/18/67	Union Oil Co. of Calif.	W. Thornton-Walnut Grove Gas	"Unit Line Well" 2	3-1/2 hours	No	Gas	None
OPERATION:	Pulling perforating gun.	CAUSE:	Swabbed the well. (In addition, the perforating gun was blown into the BOPE, where it became lodged, rendering the BOPE useless.)				
03/12/70	Amerada Hess Corp.	Helm	"Steines" 72-23	28 hours	No	Gas & water	None
OPERATION:	Pulling perforating gun.	CAUSE:	Inadequate fluid weight (water). Also, no CSO rams. (Tubing, which was partially run into the hole so the pipe rams could be used, was blown out of the hole.)				
10/08/73	Montara Petroleum Co.	Chowchilla Gas	"Chowchilla Unit 1" 2	24 hours	No	Mud	None
OPERATION:	Pulling testing tool after shooting four holes. (Pulled 19 stands.)	CAUSE:	Inadequate mud weight (only a 50 psi overbalance). Possible water entry through cement-port holes at 1,040 feet, thereby reducing the mud weight.				
01/30/74	Chanslor-Wstrn. Oil & Dev. Co.	Midway-Sunset	No. 75	6 hours	No	Mud, oil, gas, & water	None
OPERATION:	Pulling drill pipe after gravel packing.	CAUSE:	Swabbed the well.				

08/14/75 Samson Resources Helm "Helm Unit" 5-27 6-1/2 days No Gas 1 injured

OPERATION: Perforating a new interval.

CAUSE: Inadequate fluid weight (brine). (Also, surface equipment was cut out due to sand erosion. The well began to flow again when the tubing and packer were run.)

02/28/84 E. B. Brooks, Jr. Santa Paula "Anlauf" 2 Short (kick) No Gas, mud, & cement None

OPERATION: The BOPE was being disconnected after the production casing was cemented.

CAUSE: Insufficient cement in the surface casing/production casing annulus and insufficient setting time.

During Plugging and Abandonment Operations

06/19/53 H. S. Rothschild & J. E. Kebow Ventura "Courtney Community" 1 10 minutes No Oil & gas None

OPERATION: Cutting the water string and preparing to pull the casing while abandoning the well. (The bottom-hole plug was in place.)

CAUSE: Inadequate fluid weight (oil-based fluid). (Also, no BOPE.)

03/12/56 Dow Chemical Co. Playa Del Rey "Recreation Gun Club" 10 36 hours No Gas None

OPERATION: Pulling casing (11-3/4") during abandonment operations. (The well was being used to produce saltwater for iodine recovery.)

CAUSE: Insufficient hole fluid and/or fluid weight to counteract the pressure of a shallow gas sand at 887 feet.

11/12/63 Paul F. McKenzie Huntington Beach "Doug" 1 2-1/2 hours No Gas None

OPERATION: Pulling out of the hole with a bailer after dumping the first load of cement. (Placing a bottom-hole plug while abandoning the well.)

CAUSE: No BOPE and well was swabbed with a bailer.

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Plugging and Abandonment Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
12/16/71	Union Oil Co. of Calif.	Santa Fe Springs	"Howard" 10	1 hour	Yes	Gas	1 dead, 3 injured
OPERATION:	Placing a cement plug (squeezing) during abandonment operations.	CAUSE:	No BOPE. (Open casing-tubing annulus.)				
07/15/74	Olean Freres Corp., Opr.	Edison	"Standard" 58	20 minutes	Yes	Oil & gas	1 injured
OPERATION:	Circulating out well fluids during abandonment operations.	CAUSE:	No BOPE. (Gas came out of solution as oil was circulated from the well.)				
09/25/75	Montara Petroleum Co.	Trico Gas	"Lee Community" 5	3 hours	No	Gas	None
OPERATION:	Pulling casing (5-1/2") from 365 feet while abandoning the well.	CAUSE:	Insufficient hole fluid. (The fluid level dropped when the casing was shot.)				
04/28/77	Shell Oil Co.	Saticoy	S.P.S. 36	2-1/2 hours	Yes	Gas	None
OPERATION:	Changing over to clay-based mud during abandonment operations.	CAUSE:	Circulated a gas bubble in the well fluids.				
03/22/79	Chevron U.S.A. Inc.	Midway-Sunset	No. 44	1/2 hour	No	Oil & gas	None
OPERATION:	Pumping a cement plug while abandoning the well.	CAUSE:	No BOPE. (The oil had not been displaced from the well bore with drilling mud before cementing operations were begun, and dissolved gas was released from the crude oil as it was displaced by the cement.)				
09/24/81	Southern California Gas Co.	Ten Section	No. 35-29	10-1/2 days	No	Gas, water, & rocks	1 injured
OPERATION:	Changing elevators. (Stuck tubing had been cut and pulled from 5,900 feet during the abandonment of the well.)	CAUSE:	Insufficient hole fluid. (In addition, the annular preventer, the only BOPE on the well, was cut out by blowing gravel.)				

01/31/82	Franklin Oil Co.	Devils Den	"Dagney Gap Unit" 31	27 hours	No	Gas, water, sand, & mud	None
OPERATION:	Pulling drill pipe to place another abandonment plug.	CAUSE:	Swabbed well. (The situation was possibly compounded by not keeping hole full of mud.)				

During Other Operations

12/19/52	M. Barratt and E. W. Bysshe	Bardsdale	"Bardsdale" 2	5 hours	Yes	Gas	4 injured
OPERATION:	Weighting up the hole fluid while preparing to remove a 5 1/2-inch liner.	CAUSE:	Inadequate fluid weight (oil-base mud, about 60 lbs. per cubic foot at the time of the blowout). In addition, the fire damaged the element of the annular preventer, rendering it ineffective.				
06/27/54	Standard Oil Co.	Oxnard	"McInnes" 2	15 hours	No	Oil & gas	None
OPERATION:	None - producing well.	CAUSE:	Packing seal between casing strings failed. Also, the surface pipe failed in the cellar.				
09/21/54	Petroleum Enterprises Co.	Trico Gas	"Tulare" 1	24 hours	No	Gas	None
OPERATION:	Standing well - awaiting conversion to a water well.	CAUSE:	Inadequate fluid weight. Well was left open at the surface, pending conversion to a water well. Although the well was plugged back to 1,155 feet, the surface casing only extended to 398 feet. The area was known to have shallow gas deposits.				
11/21/54	Tidewater Associated Oil Co.	Chowchilla Gas	"Redman-Stone" 2-20	24 hours	No	Gas	None
OPERATION:	None - producing well.	CAUSE:	Christmas tree failure. (Sand cut out the Christmas tree.)				
12/04/54	Franco Western Oil Co.	Pyramid Hills	"Norris-Drilexco-Bayliss" 62-29	24 hours	No	Gas	None
OPERATION:	Running tubing.	CAUSE:	Inadequate mud weight, in spite of weighting the hole fluid to 85 pounds per cubic foot.				

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Other Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
05/03/55	Warren L. Meeker	Sunset Beach	"Freeman" 1	3 hours	No	Oil & gas	None
OPERATION:	None - producing well.	CAUSE:	A crane hook, which fell while the drilling derrick was being dismantled, broke a well-head nipple.				
06/02/55	Standard Oil Co.	Huntington Beach	"Atlanta Ave. Comm." J-8	7 hours	No	Oil & gas	None
OPERATION:	Pulling casing (7") preparatory to redrilling.	CAUSE:	Insufficient hole fluid (probably due to lost circulation). (Also, the annular preventer was damaged when the casing was dropped following the kick, and the actuating system malfunctioned.)				
12/05/55	Chase Production Co.	Oxnard	"Chase" 2	24 hours	No	Oil & gas	None
OPERATION:	Standing well.	CAUSE:	After pulling tubing, the well was filled with saltwater and left unattended with no BOPE.				
02/03/56	Shell Oil Co.	Ventura	"Edison" 13	7 hours	No	Saltwater w/some oil	None
OPERATION:	Pulling tubing and packer (converting well from gas lift to rod pump).	CAUSE:	Swabbed well.				
06/09/56	Los Nietos Co., Operator	East Coalinga Extension	"Coalinga Fee" 1	Unknown	No	Water & gas	None
OPERATION:	Producing well. (Also, six other wells were affected.)	CAUSE:	A hole at about 750 feet in the water string of one producing well (about 125 feet below the shoe of the surface casing) allowed gas to migrate through shallow sands and gravels and enter the annuli of six nearby wells. (Gas and water were blowing from the surface casing/water string annuli.)				

12/27/59	Western Gulf Oil Co.	Paloma	"L.A. Club" 28-6	2 hours	Yes	Gas	2 injured

OPERATION: Filling hole with mud while preparing to pull the liner.

CAUSE: Insufficient hole fluid. (Also, the hydraulic hoses to the annular preventer were damaged in the fire.)

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01/25/62	Richfield Oil Corp.	Rincon	"Hobson State" 4	40 minutes	Yes	Gas	4 injured

OPERATION: Removing tubing head after pulling rods. (Preparing to clean out a stripper well.)

CAUSE: Insufficient hole fluid.

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01/27/64	Franwin Oil and Gas Co.	Kirkwood Gas	"Morgan" 4	12 hours	No	Gas	1 injured

OPERATION: Adding foaming agent.

CAUSE: Tubing valve broke off.

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06/02/64	Standard Oil Co.	Placerita	"Placerita" 16	3 hours	No	Oil	1 injured

OPERATION: Pulling tubing and packer after steaming.

CAUSE: No BOPE. (Pressure gauge had shown no pressure on well after bleeding off steam.)

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09/12/65	Occidental Petroleum Corp.	Kern River	"Rodgers" 1	Unknown	No	Steam	None

OPERATION: Injecting steam.

CAUSE: The well had been completed (without division approval) with an uncemented, 5-1/2" liner landed inside 8-5/8" casing with a packer assembly. About 900 feet of the 5-1/2", 17# casing and 925 feet of the 2-3/8" tubing blew out of the well.

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09/14/65	Socony Mobil Oil Co.	Midway-Sunset	"MOCO 35" T-592	3 days	No	Steam	None

OPERATION: Idle air injector (scheduled for remedial work).

CAUSE: The seal between casing strings failed.

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Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Other Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
10/26/65	Tidewater Oil Co.	Kern River	"Tarr & McComb" 4	Unknown	No	Casing, tubing, & steam	None
OPERATION:	Steam injection well.	CAUSE:	Five feet of casing was added at the surface and secured with only two tack welds. The welds failed, allowing the top five feet of casing and the tubing to be blown from the well.				
12/18/68	Getty Oil Co.	Aliso Canyon	"SFZU" P-31	6 days	Yes	Gas	None
OPERATION:	Routine valve change. (Flowing well.)	CAUSE:	Gas leakage during valve change.				
01/03/70	Getty Oil Co.	Buena Vista	No. 17-A	1 day	Yes	Gas	None
OPERATION:	Pulling suction washing tool after acidizing perforations.	CAUSE:	Insufficient hole fluid (water). Also, the BOPE controls were too far from the well site to be used in time, and the suction washer got hung up in the BOPE, which could not be closed.				
01/05/70	Marathon Oil Co.	Paloma	"KCL-N" 7	3-1/2 hours	No	Gas	None
OPERATION:	Producing well. (Producing gas only.)	CAUSE:	The well head was hit and broken off by a bulldozer. (The well was in an area that was being strip-mined for gypsum.)				
11/27/71	Mobil Oil Corp.	San Ardo	"Orradre" 52R-12	12 hours	No	Air & oily sand	None
OPERATION:	Rigging up to pull a damaged liner. (Working in an active fireflood area.)	CAUSE:	Inadequate fluid weight. (Although an annular preventer had been bolted down, the well blew out before the control lines were connected.)				
09/30/72	Ancora-Verde Corp.	Fruitvale	"Ansolabehere" 8	4 hours	No	Oil & gas	None
OPERATION:	Pulling rods and tubing. (The well had been shut in for six weeks.)	CAUSE:	No BOPE.				

11/18/74	Tesoro Petroleum Corp.	Cymric	"M. & L." 3-20	39 hours	No	Gas	1 injured

OPERATION: Retrieving a pressure bomb.

CAUSE: Pulled the valve and lubricator out of the well head while pulling a pressure survey instrument.

01/19/75	Southern California Gas Co.	Aliso Canyon	"Fernando Fee" 36	10 days	Yes	Gas	None

OPERATION: Producing (gas storage) well.

CAUSE: Sand production cut out an elbow on the production line near the well head.

04/18/75	Sunrise Petroleum Co.	Helm	"Community Six" 88-24	5 hours	No	Oil, gas, water, & sand	None

OPERATION: Producing well. (There was very little gas production prior to the blowout.)

CAUSE: The adjustable bean was cut out by sand. (The well began producing gas two days after oil production started, apparently due to a lowered fluid level.)

08/21/75	Atlantic Oil Co.	Grand Island Gas	"Grand Island" 1	2 days	Yes	Gas, water, & sand	1 injured

OPERATION: Shut-in gas well. (Awaiting hookup to a sales line.)

CAUSE: The well head was damaged by a caterpillar tractor. (A farm worker drove into the Christmas tree as he was trying to clear weeds with his plow discs on the gravel well pad.)

10/02/75	Marmac Resources	Rosecrans	"Marine" 37	1-1/2 hours	No	Gas	None

OPERATION: Cutting casing (6-1/4") for recovery before redrilling.

CAUSE: No BOPE. (The fluid level dropped shortly after the casing was shot; then, the mud was blown out of the hole.)

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Other Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
10/25/77	Williams Brothers Eng. Co.	Elk Hills	No. 333-5G	46 hours	Yes	Oil & gas	3 dead
OPERATION:	Attempting to pull a packer assembly through a snubbing unit on a producing well.	CAUSE:	The packer was too big for the pipe rams and got hung up in the snubbing unit. All four rams were then opened in an attempt to free the packer, allowing oil and gas to escape at 1,000 psi pressure. The vapors were ignited by a generator unit near the well.				
05/31/78	Williams Brothers Eng. Co.	Elk Hills	No. 312-31S	45 hours	No	Gas	None
OPERATION:	Preparing to mill out a packer.	CAUSE:	When the BOPE was closed during a kick, the previously loosened hold-down bolt (for the donut) blew out.				
05/30/79	Shell Oil Co.	Orcutt	"Careaga" 37	24 hours (?)	Yes	Gas	1 injured
OPERATION:	Pulling tubing.	CAUSE:	No BOPE. (Gas, venting at a low rate from the casing, accumulated beneath the rig and caught fire.)				
12/10/79	Santa Fe Energy Co.	Kern River	"Kern County Land Co." 1	2-1/2 hours	No	Oil & steam	None
OPERATION:	An idle well in a steamflood project.	CAUSE:	Communication with an adjacent steam-injection well.				
01/24/80	Champlin Petroleum	Inglewood	"Champlin Ladera Park" 1-16	5 hours	No	Oil, water, & gas	1 dead
OPERATION:	The well was shut in during a pressure buildup test.	CAUSE:	Nipple and lubricator failure.				

08/21/80	Crown Central Petroleum	Tapia	"Hartje" 2	7 hours	No	Gas	None

OPERATION: Rods and tubing had been pulled.

CAUSE: Insufficient hole fluid (fluid level at 180 feet) and no BOPE.

08/29/80	Getty Oil Co.	Lost Hills	A-123	3-1/2 days	Yes	Oil & gas	None

OPERATION: Well changeover following fracturing treatment.

CAUSE: A vacuum truck, after catching the mud returns, pulled away from the well with the hose still connected, damaging the well head.

11/15/81	Williams Brothers Eng. Co.	Elk Hills	No. 375-24Z	2 days	No	Gas	None

OPERATION: Running a sleeve assembly into the well.

CAUSE: The well kicked and the CSO rams were closed by mistake, crimping and splitting the tubing.

07/02/83	Williams Brothers Eng. Co.	Elk Hills	No. 333-24Z	8 hours	No	Gas	None

OPERATION: Setting a wireline bridge plug.

CAUSE: No BOPE. During removal, the bridge plug stuck in the well head. The crew then removed the lubricator to find the problem, and the well blew out. (The lubricator could not be reattached because of the stuck bridge plug.)

12/17/83	Williams Brothers Eng. Co.	Elk Hills	No. 324-30R	3 days	Yes	Gas	None

OPERATION: Standing well following acidization. (Well unattended.)

CAUSE: The tubing was left open to a production tank and the well was left unattended. (A gas leak developed in the 7" x 9-5/8" casing annulus due to a poor primary cement job and failure to perform remedial cementing.)

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Other Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
02/14/84	S & C Oil Co.	Torrance	No. 3	24 hours	No	Water, sand, mud, & air	None
OPERATION:	Producing well.	CAUSE:	An elbow washed out on the bleed line running from the casing head to the tank farm.				
10/03/84	Shell Western Expl. & Prod. Inc.	Mount Poso	"Bohen" 8	8-1/2 hours	No	Steam, sand, & mud	None
OPERATION:	An abandoned well.	CAUSE:	The annular surface plug failed when a hole in a steam injector (25 feet away) opened communication with the annulus of this well.				
11/14/84	Shell Western Expl. & Prod. Inc.	South Belridge	No. 635F-34	34 hours	No	Steam & sand	None
OPERATION:	Preparing to run steam surveys. (The steam packer and tail pipe were removed earlier.)	CAUSE:	No BOPE. (The BOPE was removed so the well head could be flanged up for the night.)				
01/27/85	Mobil Oil Corp.	San Ardo	"Ferrini" 66-11	33 hours	No	Steam	None
OPERATION:	Producing well in a steamflood project.	CAUSE:	Holes in the casing at about 145 feet allowed steam to channel to the surface.				
04/02/85	Mobil Oil Corp.	San Ardo	"Ferrini" 29-11	19 hours	No	Steam	None
OPERATION:	Producing well in a steamflood project.	CAUSE:	Holes in the casing at about 50 feet allowed steam to channel to the surface.				
06/15/85	Union Oil Co. of Calif.	Casmalia	"Morganti" 6	Unknown	No	Mud & gas	None
OPERATION:	Drilling out a cement plug and a bridge plug that had been in place since 1967.	CAUSE:	Insufficient mud weight. (A gas bubble had accumulated beneath the old plugs, and, although the annular preventer had been closed successfully, the gas surfaced outside the production casing.)				

08/02/85	City of Newport Beach	Newport Beach	No. 2	1 day	Yes	Oil, water, & gas	None
OPERATION:	Pulled flanged wellhead. (Preparing to clean out the well, which had been used as a pressure-observation well.)	CAUSE:	Inadequate fluid weight (salt water) and no BOPE.				
12/29/85	Chevron U.S.A. Inc.	Midway-Sunset	"Monarch" 41	4 days	No	Steam	None
OPERATION:	Well was sitting abandoned.	CAUSE:	Steam channeled up the 8 5/8 x 10 3/4 inch casing annulus. The annulus had not been cemented properly upon abandonment.				
08/07/87	Shell Western Expl. & Prod. Inc.	Coalinga	"Esperanza" 25	5-1/2 hours	No	Steam	None
OPERATION:	Well was on pump.	CAUSE:	Steam came up between the casing strings.				
08/28/87	Chevron U.S.A. Inc.	Coalinga	No well	5 days	No	Steam	None
OPERATION:	Lease was being steamed.	CAUSE:	Steam erupted from the ground about 100 feet west of injection well 8-1W. Water was pumped down a nearby producing well, which caused the steam blow to cease but also caused a crater 40 feet long and 20 feet wide to appear.				
09/03/87	Mobil Oil Corp.	San Ardo	"Ferrini" 1105-11	3 hours	No	Steam	None
OPERATION:	Production well in a steamflood project.	CAUSE:	A backhoe being operated near the well head struck a line connected to the casing-tubing annulus and broke open a port in the well head.				
12/30/87	Chevron U.S.A. Inc.	Placerita	"USL" 4	5 hours	No	Oil & steam	None
OPERATION:	Pulling the well after a steam cycle.	CAUSE:	Swabbed the well.				

Table D. Oil- and Gas-Well Blowouts in California, 1950-1990.

During Other Operations

Date	Operator	Field	Well & Cause	Duration	Fire	Substance	Injuries
02/25/88	Coastal Oil & Gas Corp.	Careaga Canyon	"Hunter-Careaga" 3	6-1/2 hours	Yes	Gas & oil	None
OPERATION:	Pumping with a submersible pump.	CAUSE:	An electrical short in a power cable to the submersible pump caused a fire that destroyed the packoff element, allowing uncontrolled flow.				
02/29/88	Texaco Inc.	Cat Canyon	"M. Dias" 5	15 minutes	No	Oil, water, & sand	None
OPERATION:	During a workover, uncontrolled flow began when the wellhead was removed.	CAUSE:	No BOPE.				
03/02/88	Chevron U.S.A. Inc.	West Montalvo	"McGrath 4" 82-5	22 hours	No	Gas	None
OPERATION:	Blowing down the well to replace the production tree.	CAUSE:	Gas and sand cut out a 45 degree tube turn in the production line. The production valve leaked and was cut out, causing a loss of control.				
04/12/88	Shell Western Expl. & Prod. Inc.	Kern River	"Rogers" 11	3 hours	No	Steam	None
OPERATION:	Well shut in for over two years.	CAUSE:	Steam injection from adjacent well (+/- 70 feet away) apparently migrated into well and up casing, blowing off a bullplug.				
09/08/88	Seneca Resources Corp.	Sespe	"Powell" 1	5 days	Yes	Oil & gas	1 injured
OPERATION:	Circulating out fill in preparation for frac job.	CAUSE:	Fire in shaker pit, possibly caused by faulty bug fan, spread to nearby Baker tanks and then to well cellar. Fire caused failure of well-head equipment, and well blew out.				

10/17/88	Shell Western Expl. & Prod. Inc.	Kern River	"China" 131	10 hours	No	Oil & steam	None	OPERATION: Putting the well back on production after steam cycle.	CAUSE: BOPE failed after well kicked upon opening after eight days of steaming.
12/19/88	Texaco Producing Inc.	San Ardo	"Orradre" NN37-10	2 hours	No	Oil, water, & steam	None	OPERATION: Well was pumping.	CAUSE: Well head was damaged when pump froze.
03/28/89	TXO Production Corp.	Malton-Black Butte Gas	"McKenna" 10-1	24 hours	No	Gas	None	OPERATION: Hooking up to gathering line.	CAUSE: The crossover nipple between the master valve and the tubing-head assembly failed when torque was applied to a wing valve during hook-up operations.
05/17/89	Shell Western Expl. & Prod. Inc.	Arroyo Grande	"Rock" 14M	30 minutes	No	Steam	None	OPERATION: Replacing tubing with insulated tubing.	CAUSE: Actuating handle on pipe rams left in neutral position overnight, allowing pressure on rams to bleed off.
07/27/89	Mobil Oil Corp.	Midway-Sunset	"Moco 35" MT-262	3 hours	No	Steam	3 injured	OPERATION: Running casing scraper during rework.	CAUSE: Insufficient hole fluid.
06/18/90	Texaco Producing Inc.	San Ardo	"Rosenberg NCT-1" RR33	15 minutes	No	Steam	1 injured	OPERATION: Swabbing the hole.	CAUSE: Insufficient hole fluid (cold water) to quench live steam entering well.
12/06/90	Shell Western Expl. & Prod. Inc.	Arroyo Grande	"Rock" M-5	1-1/4 hours	No	Oil & steam	None	OPERATION: Well was on production.	CAUSE: A nipple on the casing failed.